REMARKS

The Examiner is thanked for discussing the case with the undersigned on August 23, 2006. The claims have been amended based upon the Examiner's helpful comments made at that time.

Claim 1 has been amended to state that the hard film has a combination of lubricity, low friction coefficient, wear resistance, small specific abrasion loss, and adhesion to a substrate in an aqueous environment. The added description is supported at page 3, lines 10-12, of the specification and the properties listed in Tables 1 and 2. A minor spelling change has been made in Claim 2. The pending claims remain Claims 1-6; Claims 5 and 6 stand withdrawn.

Applicants acknowledge the Examiner made the restriction requirement final but respectfully submit that at least Claim 5 should be rejoined with the examined claims, if that subject matter is found allowable.

The rejection of Claims 1, 3, and 4 under 35 U.S.C. § 102 as anticipated by BASF (DE 3803014) or Seiko (JP 02-189748) or Ulvac (JP 06-158272) or Riken (JP 05-195196) is respectfully traversed. The Examiner asserts that each reference "discloses the claimed film with the claimed proportions of components therein." Applicants respectfully disagree.

The present invention is directed to an improvement in the hard film art in which the hard film of the present invention is made of a material containing a compound with designated amounts of (1) an element from any of groups 3A, 4A, 5A and 6A and aluminum, (2) silicon, (3) carbon, and (4) nitrogen, the quantity of silicon in the compound being controlled such that the atomic ratio of silicon is at least 0.45 and not more than 0.98. Preferred aspects of the invention are recited in Claims 2, 3, and 4. The hard film of the present invention is particularly useful because it improves the lubricity and wear resistance of sliding members lubricated with a water-based lubricant rather than with a lubricating oil.

The hard film, as confirmed by the properties shown in the working examples reported in Tables 1 and 2, has a combination of lubricity, low friction coefficient, wear resistance, small specific abrasion loss, and adhesion to a substrate in an aqueous environment. Claim 1 has been amended to state these properties.

The detailed disclosure in the specification including a lengthy explanation of both the working and comparative examples as they appear in Tables 1, 2 and 3 shows the need to maintain the atomic ratio of silicon in the compound within the specified range of 0.45 and 0.98. Table 2 shows the advantages of having an oxygen component in the compound. The paragraph in the specification bridging pages 8 and 9 explains that the addition of oxygen will enhance the water lubricity and wear resistance of the hard film. Oxygen also will oxidize part of the silicon to promote bonding between the silicon and hydroxyl groups in the aqueous environment, thus lessening the frictional property of the hard film.

BASF DE '014 does not show the proportions called for in the present claims, particularly the controls on the quantity of silicon in the compound. The working and comparative examples of the application establish the advantages of using silicon in such proportions. The formula in the reference at page 6, lines 50-61 permits Al or Si to be absent. The formula also mandates the plasma of other metals; M^1 and M^2 must be present in an atom ratio of at least 0.005 for both. The claims patentably define thereover.

Seiko JP '748 shows an AlSiNC:H protective film but the reference is silent regarding need for the controls specified in the instant claims. Tables 1 and 2 of the present specification establish the need to control the silicon content within the stated range to achieve good hardness, adhesion, friction coefficient (in an aqueous environment), and wear resistance.

Ulvac JP '272 describes a resistance film containing titanium, zirconium, silicon, carbon, and nitrogen containing 5-60% silicon. The reference, however, as the references

already discussed does not teach or suggest to the person of ordinary skill in the art the particular limits of the instant claims and the advantages achieved thereby; the rejection should be withdrawn as well.

Riken JP '196 describes a chromium silicon nitride sliding material with a designated weight ratio of chromium to silicon to nitrogen that is said to have drastically improved sliding properties. It is believed apparent from the date of the publication the property discussed is an oil sliding property and not a water sliding property which is the major advantage of the present invention. The reference does not teach the limits of the present claims or the need to observe them. The rejection should be withdrawn.

The rejection of Claims 1-4 under 35 U.S.C. § 102 as anticipated by Hitachi Tool (JP 2001-121314) is also respectfully traversed. The hard film of that reference embraces embodiments where no silicon is present and there is no proper teaching or suggestion of the present invention therein. A person of ordinary skill in the art would not be directed to the present invention from the ranges given in the reference. The Examiner is again directed to Tables 1 and 2 of the specification. The rejection should be withdrawn.

The rejection of Claims 1, 3, and 4 under 35 U.S.C. § 102 as anticipated by Mitsubishi Material (JP 09-01104 or 08-118106) is also respectfully traversed. The designated amounts of silicon in the various hard film compounds do not teach or suggest the specific formulation of the present invention and the rejection should be withdrawn as well. These references, as the other discussed above, teach neither the controls, the reasons to observe them, nor the advantages resulting therefrom.

The Examiner is thanked for acknowledging receipt of the certified copy of the priority document and for listing references provided with Information Disclosure Statements.

Reconsideration of the application is earnestly solicited.

Respectfully submitted,

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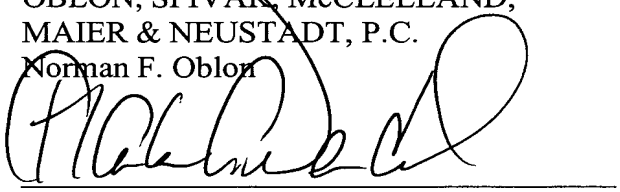

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